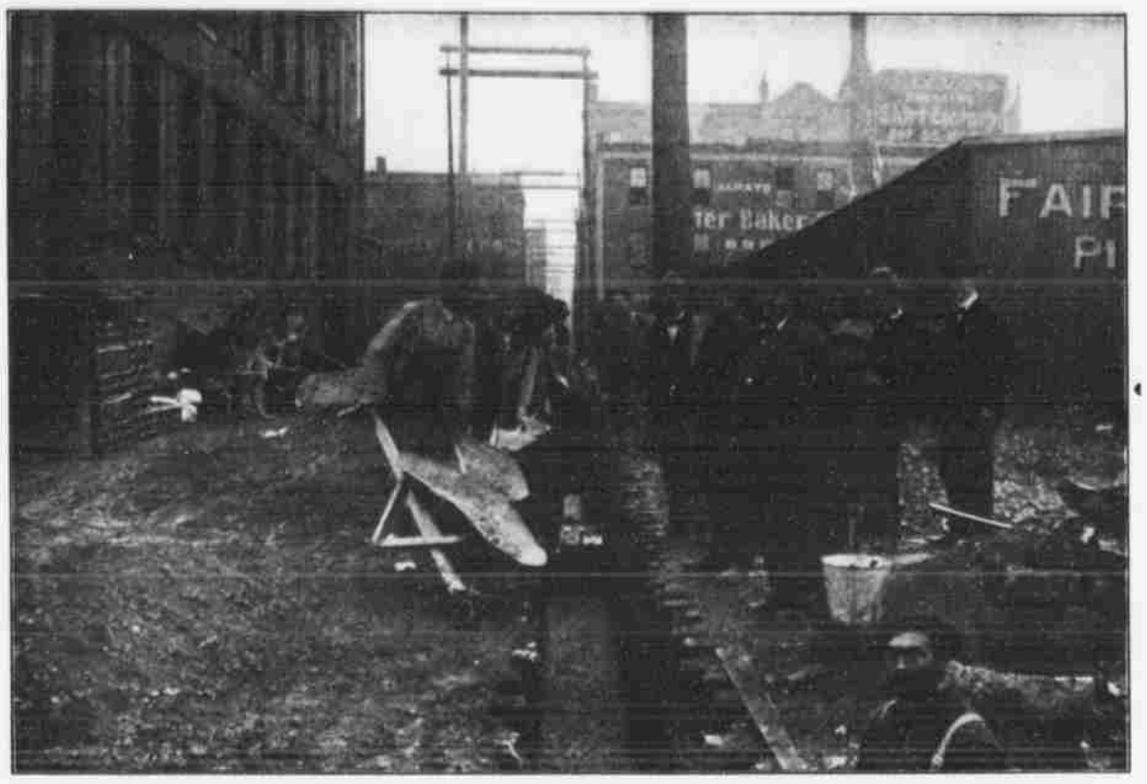
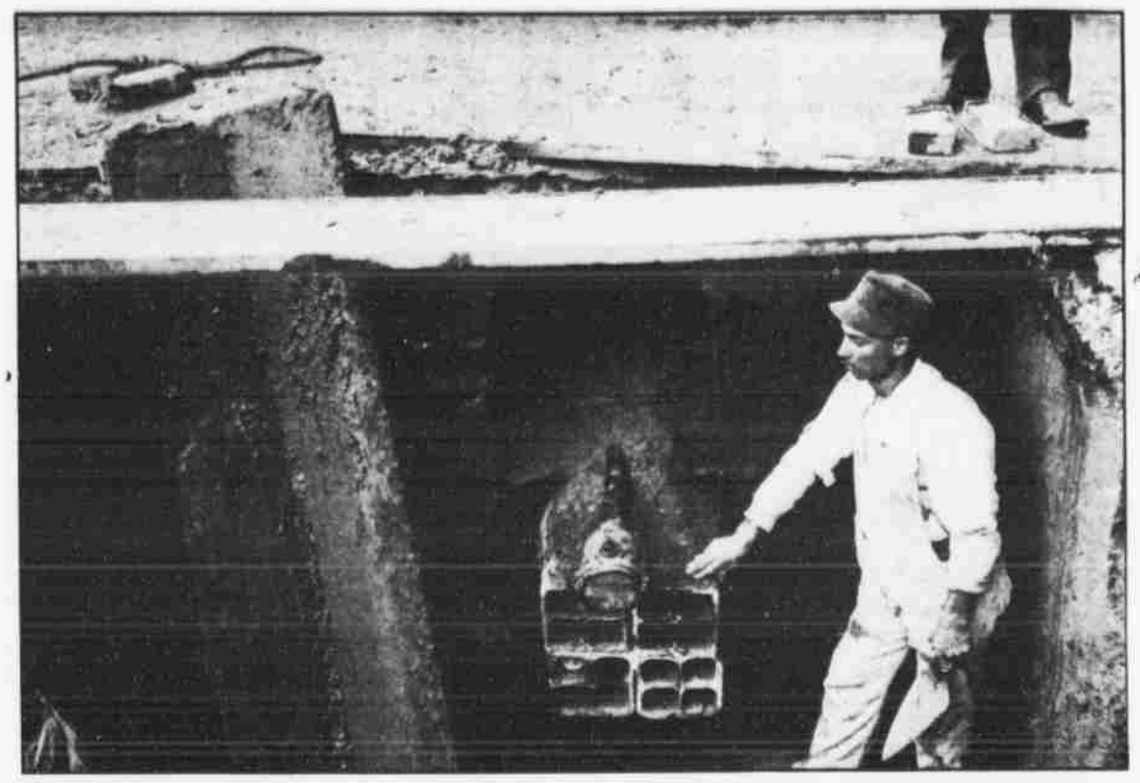
Burial of Electric Wires Along City Streets



FILLING IN THE CONCRETE BASE—Photo by a Staff Artist.



END OF A CONDUIT LINE IN A MANHOLE—MASON LAYING BRICK—Photo by a Staff Artist.

PUTTING ON THE BURLAP WRAPPER—Photo by a Staff Artist.

DITCHING GANG STOPS TO LOOK—Photo by a Staff Artist.

CONCRETE FILLING FOR THE SIDES AFTER THE TILE IS LAID—Photo by a Staff Artist.

AMONG the many problems of engineering which have perplexed the governments of the metropolitan cities of the world in the past twenty years, perhaps none has more imperatively or more constantly demanded attention than the question of the removal of electric wires from the streets. A quarter of a century ago, when the development of electricity was, as may be said, in its elementary stages, the overhead wires gave but little trouble comparatively, and the poles and cross-arms, with their few thread-like strands of wire, while not regarded as an adornment to a handsome city street, were tolerated as a necessary evil. But as new uses for the mysterious electric fluid were discovered and through the efforts of Edison and other inventors it became a familiar utility, the wires multiplied at an alarming rate and became a genuine menace to the public welfare and convenience.

Gradually the telephone grew from a luxury to be enjoyed only by a few of the larger business houses to a necessity which not only every place of business, but a large proportion of private homes, must have. The single wires multiplied in number and became great cables extending farther and farther throughout the city streets until they were not only a disfigurement to the sightly appearance of those streets, but were positively an encumbrance. Then the electric light came more generally into service and its heavily charged wires added a serious danger to the already troublesome situation, and the application of electricity as a motive power in the operation of street railways contributed still further in the same manner.

As the wires increased in numbers it became more and more apparent that they must be removed from the streets, and it was soon determined that the only practicable way to accomplish that was to place them underground. And then followed years of conflict between the authorities of the cities and the companies owning the wires before any progress in this movement could be accomplished. The expense which the burial of the wires would entail prompted opposition and resistance on the part of the companies and the imperfections of the various methods proposed gave them grounds for their refusal to adopt them or acknowledge them to be reasonable. Years and years of study and experiment effected gradual improvement in underground conduits, and this, supplemented by strong and in some cases even radical coercion on the part of city authorities, brought about their adoption more and more generally in the larger cities until now there is scarcely a city of considerable size which has not its subway system or in which overhead wires, except for street railway operation, are tolerated in the business districts.

The European cities were far ahead of those of America in the burial of electric wires for the reason that they never did permit the stringing of the wires above ground, and from the very beginning they were laid in conduits beneath the sidewalks. Even the overhead trolley wire has only been introduced into London within a few years, and it has met with such determined opposition as to indicate that it can never be extensively used. It has never been permitted that wires should be strung on poles in England and France, and as long as twenty years ago London had 25,000 miles of wires in its conduits under the sidewalks. In Buda-Pesth, Hungary, there was an underground trolley system in successful operation more than fifteen years ago.

There has been some question and some controversy as to which of the American cities was first to place its electric wires underground. In support of the claim of Chicago to this distinction it is stated that wires were first laid underground there in the form of cables in 1878 and in pipes in 1888. Philadelphia experimented quite extensively with conduits of creosoted wood in 1885, but, like many other plans, that was found to be not entirely practicable, although by means of a very high tax on telegraph and telephone poles the companies had been induced to go underground with their wires and they remained there.

The general use of clay conduits did not begin until 1891, and since that time many improvements have been made in the methods of making and of laying the tiles, but the clay subway is still used. The first cities to use these clay subways were Baltimore and Washington, where the telephone wires were taken from the streets in 1890 and the telegraph wires in 1891 and the others soon followed. In the adoption of the subway plan of Washington, Andrew Rosewater, now city engineer of Omaha, played an important part as chairman of an electrical commission appointed by the president to investigate that subject with reference to the District of Columbia and report a plan. The other members of this commission were Lieutenant Francis Shunk, U. S. A., now captain of the engineering corps, and Professor Henry A. Rowland, chief of the department of original research of Johns Hopkins university.

New York had its own subway—owned by the city—in operation in 1891. The system was under the direction of a commission which was empowered to fix rates of rental to be paid by companies running their wires through the subway and for a time this plan of management caused some trouble, but that has now been overcome.

When the clay conduits were first put into service considerable trouble was caused by explosions of gas which had formed in the ducts, and disastrous accidents occurred from that cause in St. Louis, New York, Chicago, Brooklyn and several other cities, but under different conditions different remedies were found for this difficulty.

In some places the companies so stubbornly resisted the efforts of the authorities to make them place their wires underground that it became necessary to even use force as in Brooklyn and New York, where gangs of men were sent out to chop down the poles.

The city of Omaha is somewhat behind most other cities of its size and importance in this respect, but now has the burial of wires well in hand, and before spring will have all electric wires with the exception of those of the telegraph companies and the street railway company under ground.

The Nebraska Telephone company was first to adopt the movement and in 1892, in making application to the city for a renewal of its franchise for twenty-five years, undertook to bury all of its wires in the district bounded by Ninth street, Eighteenth street, Capitol avenue and Howard street. This was done and since that time the telephone company has extended its conduit system on Eighteenth street to Cuming; on Douglas to Twentieth; on Twentieth from Douglas to Harney; and on Harney to Thirty-sixth street.

Last fall the New Omaha Thomson-Houston company presented before the city council a new ordinance calculated to strengthen the company's franchise and in the proceedings which ensued the council adopted an ordinance which requires that all wires owned by commercial lighting and power companies and located in the district bounded by the river, Eighteenth street, Howard street and Capitol avenue must be placed under ground before May 1, next. This includes all electric light, heating and power wires for commercial purposes and takes in everything with the exception of the telegraph wires and those of the street railway company which are used in the operation of their cars. Those of the street railway company's wires which are used to distribute electricity for commercial purposes are included within the requirements of the ordinance.

The Thomson-Houston company began work upon its underground conduit system early in September, and by December 1 will have completed the undertaking so far as the laying of the tiles is concerned. When completed this system will afford eighty miles of single duct, and, including the cables and other accessories, will have cost approximately $175,000, although the net cost of laying the conduit will be only about $70,000.

The conduit system is constructed of clap tiles and in this case it has been necessary to use three different makes of these tiles for the reason that no one company could supply the required quantity on short notice. The tiles are made in different sizes to permit of various numbers of ducts as required, the size of the duct always being the same. The tiles are laid in a trench on a four inch bed of concrete, with side walls of concrete two inches in length and a top covering of concrete four inches deep. The separate tiles, which are three and one-half feet in length, are held in place with what is known as a "dowel pin," and the joints are wrapped with burlap and welded with cement. The ordinance requires that there shall be thirty inches between the surface of the ground and the top layer of the conduit, but in many cases obstructions have been met and it has been necessary to go beyond that depth. The volume of the conduit varies according to location and ranges from forty-eight ducts in the vicinity of the power house and the district of greatest distribution to six, and even as low as four ducts in some of the alleys of the more remote portions. Leaving the power house at the corner of Fourth and Jones streets, with forty-eight ducts the conduit carries that volume on Jones street as far as Seventh, where it is reduced to thirty-six ducts and thus continues to Ninth, and on that street to the alley between Harney and Howard streets. Then from that point to the alley between Douglas and Dodge streets the size varies from forty to twenty ducts. In the alleys between Howard and Harney, Harney and Farnam, Farnam and Douglas and Douglas and Dodge streets, the sixteen-duct size of tile is used as far as Sixteenth street and on Sixteenth street from the alley between Howard and Harney to Capitol avenue. From Sixteenth to Eighteenth street in the alleys between Farnam and Douglas and Douglas and Dodge the size of the conduit is but six ducts. On Seventh street, from Jones to Pacific streets, the size varies from twelve to eight ducts; on Thirteenth street, from the alley between Douglas and Dodge streets to Capitol avenue there are eight ducts; on Capitol avenue from Sixteenth to Seventeenth street four ducts. For the purpose of supplying arc lamps there are from each alley to the intersecting streets on Farnam, Harney, Douglas and Dodge and from Ninth to Seventeenth streets conduits of four ducts.

In the entire system there are ninety-seven manholes. Those which are located at the intersections of the streets and alleys are seven by seven feet and from seven to nine feet in depth. They are built of brick laid in cement. In the alleys the manholes are six by six feet and six feet deep. Placed at each of the street corners for arc-lamp outlets are service boxes three feet six inches square and twenty-six and one-half feet deep with water tight iron covers. All of the manholes have sewer connections for drainage.

The service connection for the power wires which carry about 500 volts will be run through conduits of rolled paper and for the secondary distributing system the Edison three-wire iron tubes will be used. In this system three bare wires are laid in the tube and the tube is then filled with an insulating compound. These wires will carry but 212 volts of alternating current for low-pressure service.

The cables in the ducts which will carry the primary current of 2,080 volts will all be lead sheathed. The Edison tubes referred to come in twenty foot lengths and are laid right in the ground. They are coupled together by split cast-iron boxes. The rolled paper conduits are laid in concrete.

In the Thomson-Houston system, and in fact with all of the light and power wires, there is absolute underground distribution and there are no wires above the surface. As to telephone and telegraph wires, this cannot be applied as there must be some overhead wires.

The conduit system used by the telephone company consists of iron pipes laid in concrete in much the same manner as the clay tiles. These conduits terminate in manholes which are generally located in the center of a block in one of the alleys and at that point the cables are run up a pole from where the distribution is accomplished. Therefore there must be overhead distribution for distances of one block.

When the tile conduits of the Thomson-Houston company are completed the next work preparatory to putting them into service will be the interesting process of rodding them or testing them with rods. The rod to be used in this test is a very ingenious mechanical device known as a "monkey," which is so constructed as to work its own way through the duct. The rod in its progress through the ducts will be followed by a wire and then the rope which in turn will be used in drawing the cables through.